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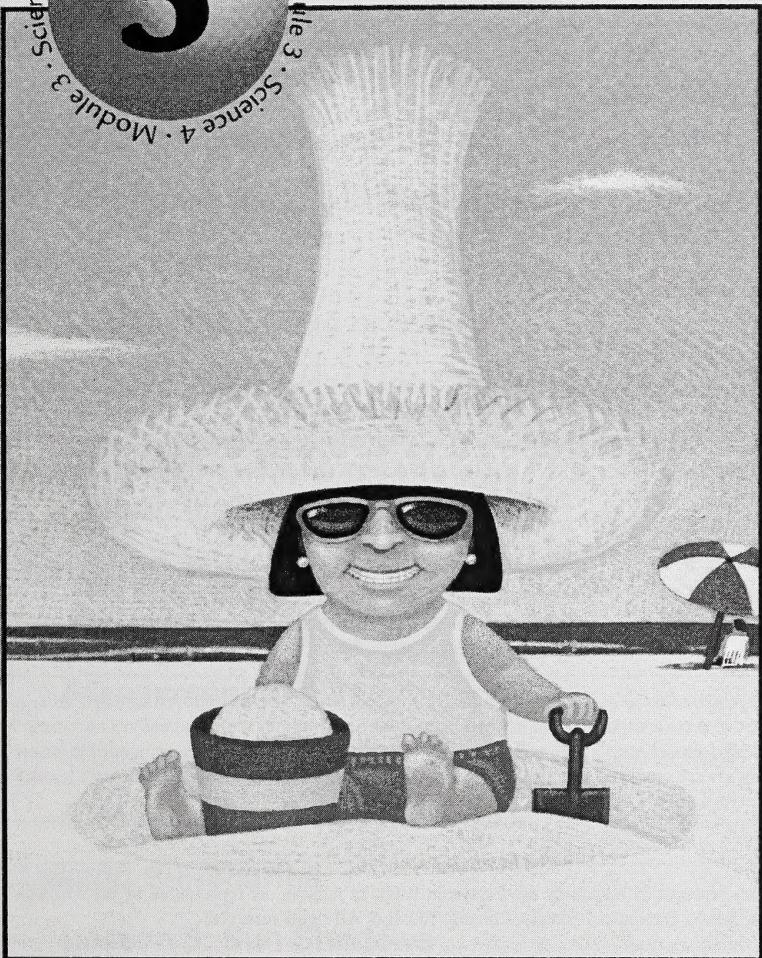
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Science 4

Light and Shadows
Home Instructor's Guide and
Assignment Booklet 3A

3

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Learning
Technologies
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Science 4
Module 3: Light and Shadows
Home Instructor's Guide and Assignment Booklet 3A
Learning Technologies Branch
ISBN 0-7741-2866-6

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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Home Instructor's Guide and Assignment Booklet.

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Teachers	✓	• Learning Technologies Branch, http://www.education.gov.ab.ca/ltb
Administrators		• Learning Resources Centre, http://www.lrc.education.gov.ab.ca
Home Instructors	✓	Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.
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Module 3: Light and Shadows

Overview

Module 3 introduces your student to the characteristics of light. Your student will be familiar with many simple concepts already. Your student will clarify her/his own existing knowledge, as well as build on it to create an understanding of more complex ideas.

Section 1 begins by identifying objects as either luminous (giving off their own light) or reflecting light from other things. Your student will then look briefly at the development of light-giving technologies, from the Sun to flame to artificial light sources such as electric bulbs and fluorescent fixtures. The section concludes with demonstrations that light travels in straight lines away from its source.

In Section 2, your student will investigate how light travels. This section clarifies that light travels in straight lines unless it is interfered with. Your student will discover how opaque objects create shadows and that some objects are translucent or transparent.

Section 3 covers ways that light's straight path can be changed. Your student will find that light can be reflected or bent by objects. Your student will examine some technologies such as mirrors and telescopes that bend or reflect light. In addition, your student will see that “white” light is composed of many colours. Your student will use some transparent objects to break up white light into rainbows of colour. Your student will experiment with coloured light and coloured pigments (paints) to see how different colours can be obtained.

Notes to the Home Instructor

This booklet contains the following components for you and your student:

1. Home Instructor’s Guide

These are notes for you. First, there is an overview, a listing of suggested websites, and a listing of additional required materials needed for the section. Then, there is an overview of the content, activities, learning outcomes, and special requirements of each lesson in the section.

Note: To ensure that you have all of the materials on hand for your student to complete the activities for each module, read through the list of materials required for the lessons. They are boxed for easy reference, as shown in the following example.

1. Activity 1: Crackling Mints

- a very dark room
- 2 Wint-O-Green Lifesaver™ candies
- a mirror

2. Assignment Record Form

This is a form to send in with the assignments. Remember to paste the address label provided by your school on it. The teacher will keep track of your student’s assignments, record your student’s grades, and include his or her comments using this form.

3. Assignment

Your student should answer all questions in complete sentences where possible. Questions set up as lists, tables, charts, or graphs do not need sentence answers. Send the assignment to the teacher as soon as the booklet has been completed.

4. Home Instructor Feedback Form and Student Feedback Form

You and your student should complete these forms. Send them in at the same time as the assignment. They provide us with helpful information about what we are doing right and what needs to be changed.

5. Checklist

The checklist helps you confirm that all of the required components have been collected prior to submitting the completed work to the teacher. For students completing this module electronically, this checklist also includes spaces to indicate the method of submitting graphs, drawings, or photos of assignment work where required.

Section 1: Light

Overview

This section introduces your student to the idea that light can be reflected or created by an object. Objects that create light are called light sources. Objects that reflect light are illuminated. Your student begins the section by identifying which objects are light sources and which objects reflect light.

Your student will find out about the progression of light sources through history, beginning with the Sun. Humans first discovered flame light sources, and they created technologies with flames that allowed caves, and then buildings, to be illuminated after the Sun set. Most recently, people have discovered electric light sources. Even within electric technologies, improvements have been made, moving from incandescent light bulbs to fluorescent bulbs to LED lights.

Because light sources often involve heat, many of the activities in this section require adult supervision. These are noted and highlighted both in this Home Instructor's Guide and the Student Module Booklet. Some activities require a sunny day; others require a dark room. You may want to review the activities to enable the best scheduling for your situation.

It would be helpful if you looked over the additional required materials for each lesson before beginning each section, in case any items need to be acquired ahead of time.

Throughout the section, your student will find A Closer Look and Imagine features, as well as optional Internet links.

Assessment and Feedback

The feedback you and your student provide in the feedback forms will assist the teacher in assessing your student's progress.

The Section 1 Assignment is worth 61 marks out of a total 179 marks for this module.

Websites Mentioned in Module 3: Section 1

It is recommended that you check these websites prior to your student beginning work on this section.

Lesson 1: Lighting or Lit Up?

- pictures of a lunar eclipse
 - http://news.nationalgeographic.com/news/2003/05/0512_030512_lunareclipse.html
 - http://www.space.com/spacewatch/lunar_eclipse_030515.html
- model of a lunar eclipse
<http://micro.magnet.fsu.edu/optics/tutorials/index.html>
- NASA Eclipse Home Page
<http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>
- Lunar Eclipse Photo Gallery
<http://www.mreclipse.com/Lphoto/LEgallery1/LEgallery1.html>
- light from candy
<http://science.howstuffworks.com/question505.htm>

The website How Stuff Works explains this phenomena. The reading level of this site may be too difficult for a Grade 4 student. Your student will enjoy having you visit it with him or her.

Lesson 2, Lesson 3, and Lesson 4

- artificial light sources and the history of the incandescent light bulb
<http://inventors.about.com/library/inventors/bllight2.htm>

Additional Required Materials

Activity 1: Crackling Mints

- 2 Wint-O-Green Lifesaver™ candies
- a mirror
- a very dark room

Activity 2: Light Bulbs

- a fluorescent bulb
- an incandescent bulb
- a thermometer, preferably an outdoor alcohol (red-fluid) type
- a watch

Activity 3: Circle of Light

- lightweight cardboard
- a small lamp with no lampshade on it
- a sheet of white paper
- a ruler, metre-stick, or tape measure
- a drinking straw*
- scissors
- tape
- a helper—the puppeteer
- a room that can be darkened

*An ice-treat stick, thin dowel, wooden spoon, or pencil will also work.

Activity 4: Light Spots

- 3 pieces of cardboard exactly the same size
- 1 piece of black paper (cardstock) the same size as the cardboard
- a flashlight
- scissors
- modelling clay
- a knitting needle or skewer
- a ruler
- a pencil
- a room that can be darkened

Optional Follow-up Activities

Activity 2A: Candlemaking—Dipped Candle

- paraffin wax or candle stubs
- 2 empty tin cans, each about 15 cm tall
- wax crayons (optional, for colour)
- heavy cotton string for a candlewick (or candlewicking)
- a saucepan
- water
- a stovetop
- a thin stick (a bamboo skewer, pencil, chopstick, ice-treat stick, or thin twig)
- 2 cereal boxes (or similar objects that can be used to suspend the candle)

Activity 2B: Candlemaking—Sand Candle

- paraffin wax or candle stubs
- 2 empty tin cans, each about 15 cm tall
- wax crayons (optional, for colour)
- a saucepan
- water
- a stovetop
- a thin stick (a bamboo skewer, pencil, chopstick, ice-treat stick, or thin twig)
- a plastic container that can be recycled (a margarine, sour cream, or yogurt container)
- heavy cotton string for a candlewick (or candlewicking)
- moist sand
- pebbles, shells, or beads (optional)
- oven mitts

Lesson Summaries

Lesson 1: Lighting or Lit Up?

Summary

In this lesson, your student will discover that some objects create their own light, while others can be seen because they reflect light. There are many more objects that reflect light than create light. A Closer Look examines the fact that stars create light, while the Moon reflects light. Lunar eclipses are introduced in a very basic way, and a website is included where your student can find out if he or she will be able to view the next lunar eclipse from home. The activity in this lesson is quite simple. It requires Wint-O-Green Lifesaver™ mints and a very dark room. If there is even a small amount of light coming into the room, it will be difficult for students to see the coloured light given off.

Learning Outcomes

It is expected that your student will be able to

- make observations about changes that occur during an experiment;
- distinguish between objects that emit their own light and those that require an external light source to be seen;
- identify a variety of light sources.

Additional Required Materials

Activity 1: Crackling Mints

- 2 Wint-O-Green Lifesaver™ candies
- a mirror
- a very dark room

Lesson 2: Artificial Light Sources

Summary

In this lesson, your student will find out about the development of light technologies, including fire, torches, candles, and lamps. Your student will discover how the light technologies that used flame helped people function in the past and how these light technologies presented dangers in the form of fires and pollution. Your student will also examine two artificial light sources—incandescent and fluorescent light bulbs. As well, your student will compare the advantages and disadvantages of both types of bulbs. The activity involves using both incandescent and fluorescent light bulbs. If your student does not have access to both types of bulbs, have him or her perform the activity with only one type of bulb. Your student should read the answers found in the Suggested Answers to know what the results would have been if he or she had been able to access both types of bulbs. Because this activity involves measuring air temperature close to hot bulbs, there are safety concerns, and adult supervision is required. If ceiling fixtures are the only examples of bulb types available, an adult should measure the air temperatures at these heights.

Learning Outcomes

It is expected that your student will be able to

- identify sources of natural and artificial light;
- describe examples of modern technologies that did not exist in the past, such as incandescent bulbs, fluorescent bulbs, and lasers;
- identify his or her family's impact on natural resources by choosing efficient mini-fluorescent bulbs;
- follow a procedure to compare the heat given off by different bulbs;
- make observations regarding which type of bulb gives off the most heat;
- draw a conclusion regarding which type of bulb wastes the most energy.

Additional Required Materials

Activity 2: Light Bulbs

Note: This activity requires adult supervision. Your student is asked to measure the temperature near a hot light bulb. If ceiling fixtures are used, an adult should measure temperatures at these heights.

- a fluorescent bulb
- an incandescent bulb
- a thermometer, preferably an outdoor alcohol (red-fluid) type
- a watch

Lesson 3: Out and Away

Summary

One characteristic of light that is often taken for granted is the fact that it travels away from a light source in all directions. In this lesson, your student will show this to be true in Activity 3: Circle of Light. Remind your student to be careful when working near a light bulb because it may be hot. Examples are given of situations where objects stop light from travelling in all directions, such as a desk lamp or ceiling light. In A Closer Look feature, your student will be introduced to the similarities between satellite dishes and car headlights.

Learning Outcomes

It is expected that your student will be able to

- describe how the position of a light source can increase the lighting level in a room or on a desk;
- provide examples of new technologies, such as parabolic satellite dishes or headlights;
- draw a conclusion regarding how light travels, based on investigation and observation;
- demonstrate that light travels in all directions away from a source and continues unless blocked by an opaque material.

Additional Required Materials

Activity 3: Circle of Light

- lightweight cardboard
- a small lamp with no lampshade on it
- a sheet of white paper
- a ruler, metre-stick, or tape measure
- a drinking straw (An ice-treat stick, thin dowel, wooden spoon, or pencil will also work.)
- scissors
- tape
- a helper—the puppeteer
- a room that can be darkened

Lesson 4: Straightening It Out

Summary

In this lesson, your student will review the idea that light travels in straight lines. Your student will be asked to think about how he or she can see light from a source that is blocked from his or her view. You can reinforce this idea by asking your student to identify which objects the light beams would reflect off when he or she stands with a light source out of view. Your student should be able to find a pathway to show that the light is bouncing off objects in straight lines and into his or her eyes. The idea of light changing direction, introduced in this lesson, will be expanded over the next lessons.

Learning Outcomes

It is expected that your student will be able to

- follow a given set of procedures to find out if light travels around corners;
- draw a conclusion about how light travels;
- demonstrate that light travels outward from a source and continues unless blocked by an opaque material;
- recognize that light can be bent or reflected.

Additional Required Materials

Activity 4: Light Spots

- 3 pieces of cardboard exactly the same size
- 1 piece of black paper (cardstock) the same size as the cardboard
- a flashlight
- scissors
- modelling clay
- a knitting needle or skewer
- a ruler
- a pencil
- a room that can be darkened

Section 2: Exploring Shadows

Overview

Shadows are cast because light travels in straight lines, and it is blocked by opaque objects. If an object allows some light to pass through and blocks the rest, the object is translucent. Translucent objects scatter light. An excellent example of a translucent object is a frosty window. Light can be seen behind the window, but specific shapes and objects cannot be recognized.

Sun shadows are a specific example of shadows cast by a light source. Your student will explore the general changes in Sun shadows as the day progresses and find out how to use the Sun to determine time and direction.

Your student will explore how to make shadows longer, shorter, wider, and thinner by changing the location of the light source and the object. After the general characteristics of shadows are explored, your student will create a puppet play to see how shadows change. A helper is needed to act as the puppeteer, so that your student can perform the activity for Lesson 7. The puppeteer doesn't have to be an adult.

A Closer Look feature gives further information about the history of shadow plays. Using a watch as a compass is one of the Optional Follow-up Activities at the end of the section.

Assessment and Feedback

The feedback you and your student provide in the feedback forms will assist the teacher in assessing your student's progress.

The Section 2 Assignment is worth 36 marks out of a total 179 marks for this module.

Websites Mentioned in Module 3: Section 2

It is recommended that you check these websites prior to your student beginning work on this section.

Lesson 5

- making a sundial
<http://liftoff.msfc.nasa.gov/Academy/Earth/Sundial/Sundial-ConstructSimple.html>

Lesson 7: Moving the Source

- more about shadow puppets
 - <http://www.osv.org/kids/crafts2.htm>
 - <http://www.magicalmoonshine.org/shadow.htm>

Lesson 8: Transparent, Translucent, and Opaque

- the history of glass
<http://www.historyforkids.org/learn/science/glass.htm>

Optional Follow-up Activities

Activity 1: Your Local UV Rating

- Environment Canada
<http://www.ec.gc.ca/>

Activity 4: Canada's Time Zones

- Canada's time zones and daylight-saving time
<http://www.canadainfolink.ca/time.htm>

Additional Required Materials

Activity 5A: Making Predictions by Using a Flashlight

- a flashlight
- a small toy (about 3 cm high)
- a sheet of paper
- a pencil
- a helper
- a dark room

Activity 5B: Measuring Sun Shadows

- coloured chalk (6 different colours)
- an outside place where you can draw on the ground (such as a concrete pad or pavement) or a big piece of cardboard or craft paper
- a sunny day
- a piece of paper (or a notebook)
- a pen or pencil

Activity 6: Exploring Shadows

- an empty, rinsed 1-L milk carton
- a dark room
- an open floor area
- a large piece of white paper (craft paper) to cover the floor, about $2\text{ m} \times 1\text{ m}$
- a metre-stick (or a measuring tape or a ruler)
- a red pencil or pencil crayon
- a flashlight
- a helper

Activity 7: Shadow Play

- the puppet you made in Section 1: Activity 3 or make a new or additional puppet
- a small lamp with no lampshade
- 2 helpers—the puppeteer and someone to move the lamp
- a tape measure or metre-stick
- tape, duct tape, or pushpins
- a screen (a white bed sheet or large piece of white paper) (Use craft paper from rolls that are used to cover tables.)
- an opening (e.g., a doorway) that you can drape the sheet across and a way to fasten the sheet (duct tape or pushpins)

Activity 8: How Much Light?

- a light source, such as a small lamp or a ceiling light
- objects to test from around your home

Lesson 5: Sun Shadows

Summary

In this lesson, your student will use his or her knowledge of shadows to predict and explain the size and location of shadows at different times during the day. A sunny day is needed for this activity, so you may have to do this lesson out of the regular order of the module. When your student is reading about why Sun shadows change the way they do, emphasize the fact that the object (in the Activity, the object is the student) is not changing its location. As well, the distance between the object and the light source is not changing a large amount. A Closer Look feature looks at sundials. Your student may wish to construct a simple sundial. Instructions are given on the referenced website.

Learning Outcomes

It is expected that your student will be able to

- follow a given set of procedures to observe how Sun shadows change;
- make observations about changes in Sun shadows;
- draw a conclusion about how Sun shadows change;
- describe changes in the size and location of Sun shadows during the day—early morning, to midday, to late afternoon;
- recognize that eyes can be damaged by bright lights and that one should not look directly at the Sun.

Additional Required Materials

Activity 5A: Making Predictions by Using a Flashlight

- a flashlight
- a small toy (about 3 cm high)
- a sheet of paper
- a pencil
- a helper
- a dark room

Activity 5B: Measuring Sun Shadows

- coloured chalk (6 different colours)
- an outside place where you can draw on the ground (such as a concrete pad or pavement) or a big piece of cardboard or craft paper
- a sunny day
- a piece of paper (or a notebook)
- a pen or pencil

Lesson 6: Shadow Shape

Summary

In this lesson, your student observes the characteristics of shadows. He or she discovers that shadows form in a straight line from the light source behind the object. Your student discovers how to change the shape and size of a shadow by changing the location of the light source. A helper for this lesson's activity will help your student make and measure shadows more easily than if he or she works alone. Changing shadows will also be reinforced in the next lesson in this section.

Learning Outcomes

It is expected that your student will be able to

- recognize that opaque objects cast shadows and that the characteristics of the shadow will change when the light source is moved relative to the object;
- test questions about the creation of specific shadow shapes and sizes;
- select and use tools for measuring the length and width of shadows;
- make observations and collect information regarding the shape, size, and location of shadows;
- draw conclusions regarding the location of shadows relative to a light source, and the location of a light source needed to create specific shapes and sizes of shadows.

Additional Required Materials

Activity 6: Exploring Shadows

- an empty, rinsed 1-L milk carton
- a dark room
- an open floor area
- a large piece of white paper (craft paper) to cover the floor, about $2\text{ m} \times 1\text{ m}$
- a metre-stick (or a measuring tape or a ruler)
- a red pencil or pencil crayon
- a flashlight
- a helper

Lesson 7: Moving the Source

Summary

In this lesson, your student continues to experiment with changing shadows. The shadow play is used again, this time to test how shadows change when the light source is moved. It is important to note that two helpers are needed for this activity—one to hold the puppet and one to move the lamp. The puppet must remain in the same place as the lamp is moved. Again, your student will decide how the changes in the shadow were made. At the end of this lesson, there is a summary that shows the different ways that shadows can be changed.

Learning Outcomes

It is expected that your student will be able to

- carry out a fair test to find out how a shadow changes when a light source is moved;
- follow a set of procedures;
- make observations and collect data;
- identify patterns in how shadows change when the light source is moved;
- draw conclusions about how shadows change when the light source is moved left, right, closer, or farther from the object;
- predict the location, size, and shape of a shadow when a light source moves.

Additional Required Materials

Activity 7: Shadow Play

- the puppet you made in Section 1: Activity 3 or make a new or additional puppet
- a small lamp with no lampshade
- 2 helpers—the puppeteer and someone to move the lamp
- a tape measure or metre-stick
- tape, duct tape, or pushpins
- a screen (a white bed sheet or large piece of white paper) (Use craft paper from rolls that are used to cover tables.)
- an opening (e.g., a doorway) that you can drape the sheet across and a way to fasten the sheet (duct tape or pushpins)

Lesson 8: Transparent, Translucent, and Opaque

Summary

All objects can be classified as transparent, translucent, or opaque. Your student will discover that a transparent object allows most light to travel through it, a translucent object allows some light to travel through it, and an opaque object allows no light to travel through it. In the activity, your student will classify objects around him or her as transparent, translucent, or opaque. Be sure that your student does not use the Sun as a light source; looking directly at the Sun can cause eye damage. Your student will also take A Closer Look at window materials that were used prior to the invention of glass.

Learning Outcomes

It is expected that your student will be able to

- test the question, “Which objects allow light to pass through them?”;
- follow a procedure to determine if objects are transparent, translucent, or opaque;
- make observations and collect data relevant to how much light passes through objects;
- investigate whether light passes through an object or casts a shadow.

Additional Required Materials

Activity 8: How Much Light?

- a light source, such as a small lamp or a ceiling light
- objects to test from around your home

ASSIGNMENT BOOKLET 3A

Science 4

Module 3: Section 1 Assignment and Section 2 Assignment

Home Instructor's Comments and Questions

FOR SCHOOL USE ONLY

Assigned Teacher:

Date Assignment Received:

Grading:

Additional Information:

FOR HOME INSTRUCTOR USE (if label is missing or incorrect)

Student File Number:

Date Submitted:

Apply Module Label Here

Name	Address		Postal Code
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*Please verify that preprinted label is for
correct course and module.*

Teacher's Comments

Teacher's Signature

Home Instructor: Keep this sheet when it is returned to you as a record of the student's progress.

INSTRUCTIONS FOR SUBMITTING THIS DISTANCE LEARNING ASSIGNMENT BOOKLET

When you are registered for distance learning courses, you are expected to regularly submit completed assignments for correction. Try to submit each Assignment Booklet as soon as you complete it. Do not submit more than one Assignment Booklet in one subject at the same time. Before submitting your Assignment Booklet, please check the following:

- Are all the assignments completed? If not, explain why.
- Has your work been reread to ensure accuracy in spelling and details?
- Is the booklet cover filled out and the correct module label attached?

MAILING

1. Do **not** enclose letters with your Assignment Booklets. **Send all letters in a separate envelope.**
2. Put your Assignment Booklet in an envelope and take it to the post office and have it weighed. Attach **sufficient postage** and seal the envelope.

FAXING

1. Assignment Booklets may be faxed to the school with which you are registered. Contact your teacher for the appropriate fax number.
2. All faxing costs are the responsibility of the sender.

E-MAILING

It may be possible to e-mail your completed Assignment Booklet to the school with which you are registered. You also may be **required** to e-mail some of your assignments. Contact your teacher for the appropriate e-mail address.

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Light and Shadows Assignment Booklet 3A

3

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Summary

Teacher's Comments

	Total Possible Marks	Your Mark
Lesson 1 Assignment	16	
Lesson 2 Assignment	19	
Lesson 3 Assignment	12	
Lesson 4 Assignment	14	
Lesson 5 Assignment	7	
Lesson 6 Assignment	4	
Lesson 7 Assignment	12	
Lesson 8 Assignment	13	
	97	

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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Assignment Booklet.

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This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	

 A circular icon with the words "Internet link" around the perimeter and a hand cursor pointing at the center.	You may find the following Internet sites useful: <ul style="list-style-type: none">Alberta Education, http://www.education.gov.ab.caLearning Technologies Branch, http://www.education.gov.ab.ca/ltbLearning Resources Centre, http://www.lrc.education.gov.ab.ca
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ASSIGNMENT BOOKLET 3A

SCIENCE 4: MODULE 3

SECTION 1 ASSIGNMENT AND SECTION 2 ASSIGNMENT

This Assignment Booklet is worth 97 marks out of the total 179 marks for the assignments in Module 3. The value of each assignment and each question is stated in the left margin.

Read all parts of your assignment carefully and record your answers in the appropriate places. If you have difficulty with an assignment, go back to your Student Module Booklet and review the appropriate lesson. Be sure to proofread your answers carefully before submitting your Assignment Booklet.

Note: If you are using electronic assignments, you will need to do the following:

- You need to print the pages that ask you to make a drawing. You will find them in your PDF file.
- You will need to mail your drawings to your teacher.

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4

Section 1 Assignment: Light

1. a. Match the words and definitions given below. Write the correct letter in each blank.

<input type="text"/> light source	A. when the Moon passes through Earth's shadow
<input type="text"/> lunar eclipse	B. an object that makes its own light
<input type="text"/> reflect	C. a group of light rays
<input type="text"/> beam of light	D. what light rays do when they bounce off an object

Your teacher is looking for

(12)

- how well you understand words that tell about light (4 marks)
- b. Fill in the following chart by answering YES or NO to the questions at the top of each column.

Object	Does this object make its own light?	Does this object reflect light?	Is this object a light source?
Sun			
couch			
television screen			
pop bottle			

Your teacher is looking for

- how well you can tell the difference between objects that create light and objects that reflect light (12 marks)

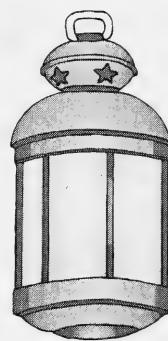


When you are ready, turn to Lesson 2 in your Student Module Booklet.

- ③ 2. a. Put the following flame light sources in order from 1 (the oldest type of light source) to 3 (the newest type of light source).



_____ candle



_____ gas lamp



_____ campfire

Your teacher is looking for

- the correct order of flame light sources from oldest to newest
(3 marks)

- ④ b. What are TWO problems with using flames as a light source?

- _____
- _____
- _____
- _____

- ④ c. Describe TWO ways incandescent light bulbs are better than flames as light sources.

- _____
- _____
- _____
- _____

- (4) d. What are TWO disadvantages of incandescent light bulbs?

- _____
- _____
- _____

- (4) e. Describe TWO ways that fluorescent light bulbs are better than incandescent light bulbs.

- _____
- _____
- _____

In questions 2.b. to 2.e., your teacher is looking for

- clear descriptions and explanations (3 marks each)
- answers in complete sentences (1 mark each)



When you are ready, turn to Lesson 3 in your Student Module Booklet.

3. How would you move an OBJECT in order to make the following changes in its shadow?

- (3) a. The shadow moves to the left.

- (3) b. The shadow moves to the right.

- (3) c. The shadow gets bigger.

- (3) d. The shadow gets smaller.

Your teacher is looking for

- clear explanations (2 marks each)
- answers written in complete sentences (1 mark each)

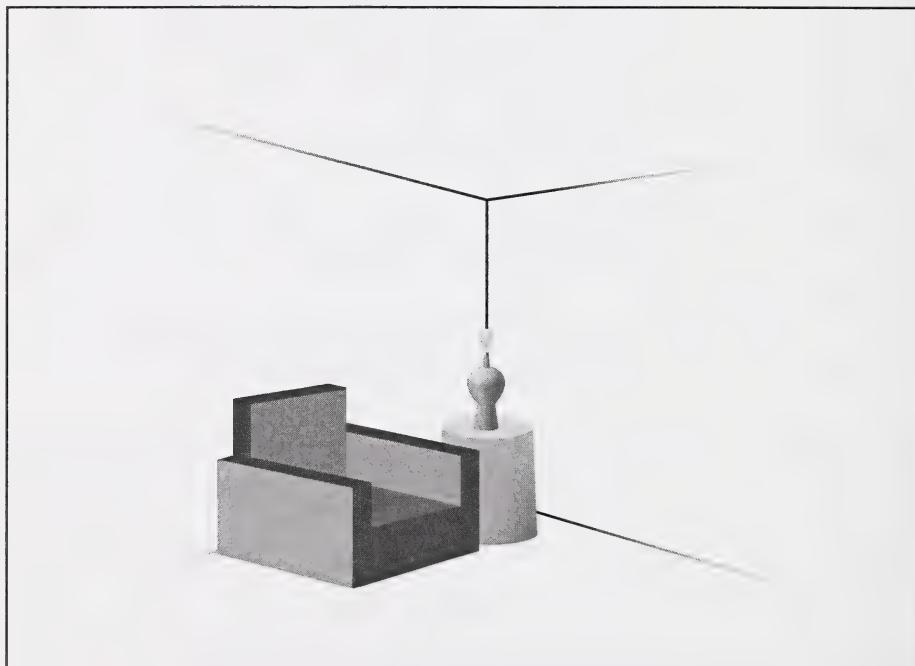


When you are ready, turn to Lesson 4 in your Student Module Booklet.

4. a. Below is a picture of a room, shown from the side. The light you can see is a small lamp in the corner of the room.

Use arrows to show where the light will travel in the room. Think about what will happen when the light reaches a wall, the ceiling, or a piece of furniture. Show this with at least four (4) arrows that you draw! Draw the arrows by using a ruler.

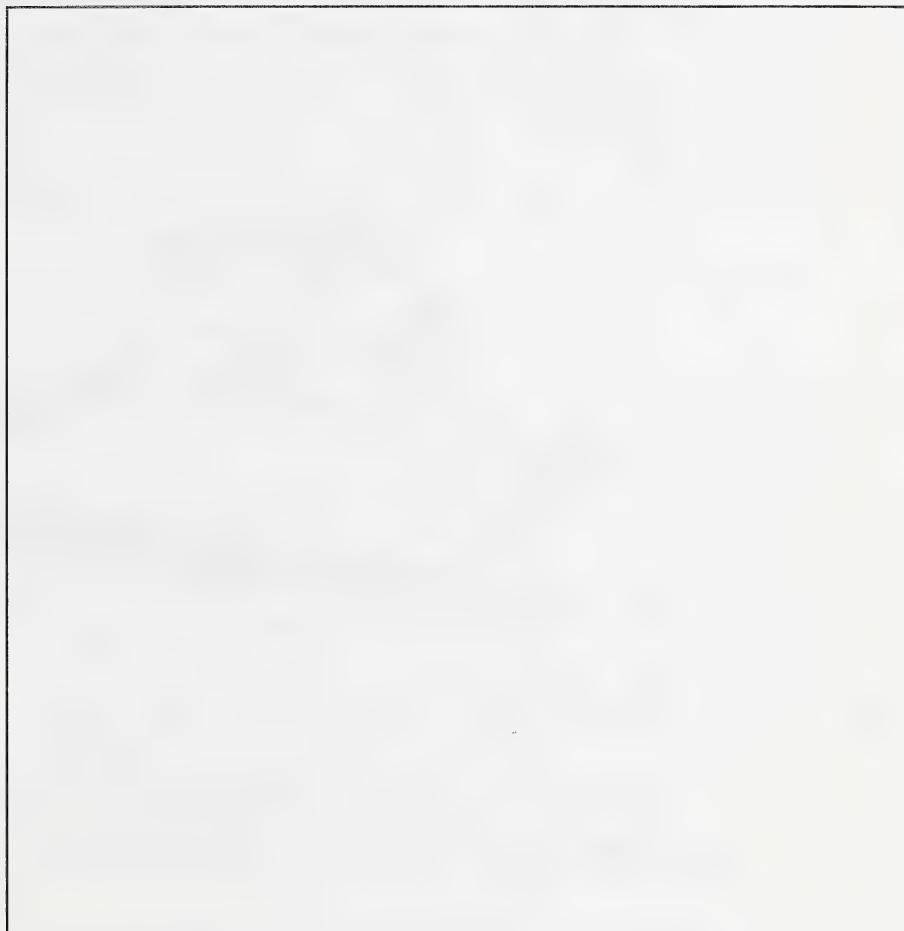
If you are completing your assignments electronically, print this page from your PDF file, complete the assignment, and mail or fax it to your teacher.



Your teacher is looking for

- arrows drawn with a ruler (1 mark)
- arrows that show how light travels out from the lamp and what happens when the light reaches a wall, the ceiling, or a piece of furniture (4 marks)

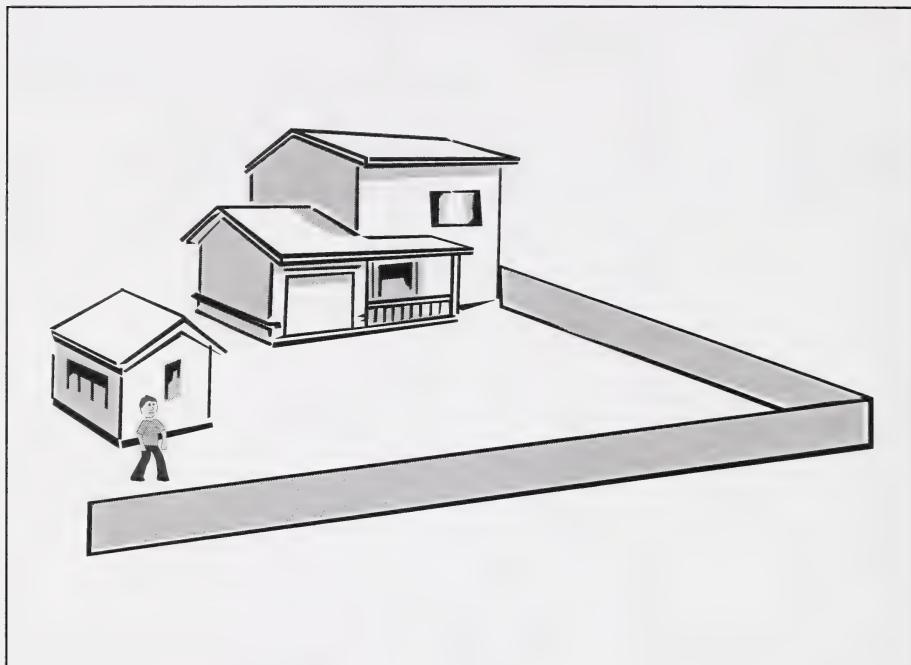
- ④ b. How do you know light does not curve around corners? You may draw a picture in the box if it helps you to explain.



Your teacher is looking for

- a clear explanation (3 marks)
- complete sentences (1 mark)

- 5 c. In the diagram below, show how the person could see light from the house from where he is standing. Draw arrows to show how the light beam travels in a straight line and reflects off opaque objects until it reaches the person.



If you are completing your assignments electronically, print this page from your pdf file, complete the assignment, and mail or fax it to your teacher.

Your teacher is looking for

- straight arrows, made with a ruler, that show how light travels from a window and reflects off opaque objects (3 marks)
- straight arrows, made with a ruler, that show how light can reach the person in the diagram (2 marks)



When you are ready, return to your Student Module Booklet and read the Section 1 Conclusion. You should then turn to Lesson 5 in your Student Module Booklet.

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Section 2 Assignment: Exploring Shadows

5. Use the following terms to complete the sentences below. You may use each word more than once.

noon sunset sunrise

- a. There is very little shade at _____.
- b. The longest shadows are made at _____ and at _____.
- c. The shortest shadows are made at _____.
- d. _____ is in the east. At this time, your shadow points toward the west.
- e. _____ is in the west. At this time, your shadow points toward the east.
- f. At _____, the Sun is very high above you in the sky.

Your teacher is looking for

- completed sentences that are true about Sun shadows
 - the correct use of the words *noon*, *sunset*, and *sunrise* to complete the sentences
- (1 mark each)



When you are ready, turn to Lesson 6 in your Student Module Booklet.

- ④ 6. Match the location of the light source with the type of shadow. Write the correct letter in each blank.

- a. The light source is far away from the object. _____ short shadow
- b. The light source is at the same height as the object. _____ long shadow
- c. The light source is high above the object. _____ wide shadow
- d. The light source is very close to the object. _____ thin shadow

Your teacher is looking for

- the correct letter that matches the location of the light source to the type of shadow (1 mark each)



When you are ready, turn to Lesson 7 in your Student Module Booklet.

7. Where would you move the **light source** in order to make the following changes in an object's shadow?

(3)

- a. The shadow moves to the left.

(3)

- b. The shadow moves to the right.

(3)

- c. The shadow gets bigger.

- (3) d. The shadow gets smaller.

Your teacher is looking for

- a clear explanation of how you would move the light source to make each change to the shadow (2 marks each)
- answers written in complete sentences (1 mark each)



When you are ready, turn to Lesson 8 in your Student Module Booklet.

- (3) 8. a. Use the following terms to complete the sentences below.

transparent **opaque** **translucent**

- A(n) _____ object does not let any light pass through it.
- A(n) _____ object lets some light pass through it, but it reflects some as well.
- A(n) _____ object lets most light pass through it.

Your teacher is looking for

- completed sentences that make sense and are correct (1 mark each)

- (10) b. Here is a list of common objects. Decide if each object is transparent, translucent, or opaque. Record each object in the column to which it belongs.

- clear drinking glass
- dill pickle
- clear window
- plastic wrap
- clean tap water
- plastic grocery bag
- notebook
- wax paper
- oak cupboard door
- frosted glass lampshade

Opaque Objects	Translucent Objects	Transparent Objects

Your teacher is looking for

- the common objects classified correctly as opaque, translucent, or transparent (1 mark each)



Now return to your Student Module Booklet and read the Section 2 Conclusion and Optional Follow-up Activities.

Home Instructor Feedback Form

Module 3: Section 1 and Section 2

Answer the following questions and mail them in with the completed assignment for this section.

1. Were there any concepts in this section that were completely new to your student? If so, what were they?

2. Activity 5B: Measuring Sun Shadows required regular observations throughout a day. What difficulties, if any, did your student encounter with this activity?

3. In Activity 7, the puppet was moved to change the shadow. How accurate were your student's guesses?

4. Which activity did your student seem to enjoy the most?

5. Did your student have access to a fluorescent light bulb in his or her home? Was he or she able to access one outside of his or her home? If so, where?

6. Did you have safety concerns regarding any of the activities in this section? If so, what were they?

Please add any questions or comments you may have.

Student Feedback Form

Module 3: Section 1 and Section 2

Answer the following questions and mail them in with the completed assignment for this section. This is not a test and there are no marks assigned.

1. Were you surprised by the results of Activity 1: Crackling Mints? Did you try the experiment with other types of mints? What did you find?

2. What did you like best about your shadow plays?

3. Imagine that you are presenting a shadow play to an audience. What characters would you choose for puppets?

4. Which activity was the hardest to do? Why?

5. Do you like to have a choice of activities? Why or why not?

Checklist for Module 3: Assignment Booklet 3A

Make sure you send in all of the following items:

- Assignment Record Form
- Assignment Booklet 3A, questions 1–8
- Home Instructor Feedback Form
- Student Feedback Form
- Optional Follow-up Activity (optional)

If you are completing your Assignment Booklet electronically, advise your teacher how you are submitting the following:

Question 4.a.

Question 4.b.

Question 4.c.
